

Risk Management in the Oil and Gas Industry

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ABSTRACT

Risk management is an essential part of any industry, which is very vital in the oil and gas industry. The oil and gas (O&G) companies have a whole lot of chemicals and hazardous substances at their disposal, to which their workers are exposed to on a daily basis. Therefore, if companies do not put in place adequate risk management strategies, they put themselves and their employees at serious risk of harm, loss of customers, loss of reputation, and court litigations. This paper delves into risk management in the oil and gas industry, challenges, and the strategies to consider to mitigating the risks.

KEYWORDS: Risks, risk management, risk analysis, climate change, global warming, risk factors, health and safety

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INTRODUCTION TO RISK AND RISK MANAGEMENT

Risk simply means the likelihood or the possibility of something bad happening. This could involve uncertainty about the effects or implications of an activity with respect to something that humans value such as health, well-being, wealth, property or the environment, often focusing on the negatives, and undesirable consequences. Hence, organizations then develop strategies to mitigate these risks that threaten the achievement of it objectives in a disciplined and objective way [1].

HISTORY OF RISK MANAGEMENT

Since the 1920s, risk management appeared in scientific and management literature, but became a formal science in the 1950s with most research related to finance and insurance. Academics at Penn first identified Henri Fayol, a Frenchman as the father of risk management in 1961. Risks can come from various sources including uncertainty in international markets, political instability, threats from project failures (at any phase in design, development, production, or sustaining of life-cycles), legal

liabilities, credit risk, accidents, natural causes and disasters, deliberate attack from an adversary, or events of uncertain or unpredictable root-cause. Risk management standards have been developed by various institutions, such as the Project Management Institute, the National Institute of Standards and Technology, actuarial societies, and ISO standards (quality management standards to help work more efficiently and reduce product failures) [2].

THE CONCEPT OF RISK MANAGEMENT

Risk management identifies and analysis the threats a company can face and control. Risks can be caused from various sources, such as financial problems, legal responsibilities, technological issues, strategic management errors, accidents, and natural disasters, as shown in Figures 1 and 2.

IMPORTANCE OF RISK MANAGEMENT

The essential goal of risk management is to eliminate or reduce unacceptable levels of risk. On a daily basis, the oil and gas companies evaluate their risks in order to achieve their goals, by continuously

assessing their operational activities and identifying the risks that are most critical to them. The importance of risk management in the oil and gas sector lies in the following [3, 4]:

1. Predict risk and determine its causes.
2. Risk analysis, assessing its impact on property and people, if any.
3. Measure risk by knowing the likelihood of its recurrence and the associated losses and be prepared to face it.
4. Choose the best methods to deal appropriately with the risk.

THE DANGERS OIL AND GAS INDUSTRY IS FRAUGHT WITH

The oil and gas industry is one of the most capital-intensive businesses in the world, and is also exposed to many inherent risks, with some more significant than others, hence the need by investors into any industry to know the risks they must face to be successful. There are general risks such as management risk, but there are also more concentrated risks that affect specific industry. Some of these risks range from commodity price volatility to environmental disasters, which can impact the companies' ability to operate successfully. Some of the biggest risks facing the oil and gas companies among others are [5, 6]:

1. The economic risks that can affect oil and gas are oil price collapse, capital cost overruns and high operating costs. Price volatility, this is as a result of crude oil prices being notoriously volatile, which is a major challenge for oil companies.
2. Transportation risks: oil companies face transportation risks throughout their value chain i.e. from production to refining to delivery of fuel products to customers e.g. a pipeline spill can have costly environmental consequences or lead to regulatory fines if not handled properly, or disruption caused by natural disaster.
3. Political risks: this is as a result of instability in government policies. It can be in changes in fiscal policies (taxes, subsidies, incentives) or regulatory policies (licensing/permit requirements). It could as well be in changes in restrictions on foreign ownership, nationalization or expropriation of assets, and political violence.
4. Environmental risks: this has to do with the impact of extraction activities on the environment, from negative health effects to damage to the ecosystem and environment. Environmental impacts also come from harmful emissions into the air or water supply.
5. Operating risk: the safety of workers is a major issue in exploration and production companies, as

well as potential cost in fines, when they fail to meet with both safety and environmental regulations.

6. Geological risk: this refers to risk in both the difficulty of extraction and the possibility that the accessible reserves in any deposit will be smaller than estimated. Therefore, oil and gas geologists must work hard to minimize geological risk by testing frequently, and so it is rare that estimates are substantially "off."
7. Oil spills: major environmental damages can be caused by oil drilling, production and transportation. These accidents harm wildlife, it hurts/damages the company's image or reputation with customers that want to buy products that are environmentally friendly. There is also the issue of climate change and global warming due to emission of greenhouse gases into the atmosphere from fossil fuel extraction. Therefore, oil companies must develop more efficient extraction techniques that would release fewer pollutants to the environment.
8. Supply and demand risks: supply and demand shocks pose real risk and the volatility in the price of oil and gas with its impact on economic factors and financial crises.

PROJECT RISK MANAGEMENT

All stages in production, transportation, and liquidation are dangerous in the oil and gas industry, such that there must be strict procedures for the managers of these enterprises to manage the risks arising from the oil and gas industry, as shown in Figure 3. Risk management in the oil and gas industry is determined by the application of safety procedures for:

1. Environment
2. Staff members
3. Means of production.

RISK FACTORS IN THE OIL AND GAS INDUSTRY

Some of the risk factors in the oil and gas industry are [3]:

- Failure to define company's safety culture.
- Failure to commit to applying the risk management plan by managers and staff.
- Lack of a specialized risk management team.
- Failure to analyse risks properly and seriously.
- Deficiencies in communication and reporting systems.
- Failure to learn from past incidents.
- Income-export inequality.
- Mixing occupational safety with system safety.
- Believing that the likelihood of practical accidents is low.

RISK MANAGEMENT MODEL IN THE OIL AND GAS INDUSTRY

The risk management objective of any oil and gas company is to ensure the continuity and stability of the production process by preventing threats and restricting the degree to which negative external and internal factors affect the company's activities. The risk management plan must be an integral part of the internal environment of an oil and gas company such as [3]:

- The implementation of mandatory risk protection procedures in the company's industrial and management activities.
- Systematic analyses of potential risks.
- Design of the company's risk control and evaluation system and protective procedures.
- Definition of risks and understanding of all means of protection by all employees and placing primary responsibility on administrators.
- Ensure regulatory support and strengthen safety and risk management procedures according to the company's policies.
- Establish a clear structure for the systematic and accurate distribution of the safety plan and risk management functions.

SAFETY HAZARDS ASSOCIATED WITH OIL AND GAS EXTRACTION ACTIVITIES

Workers in the oil and gas industries face the risk of fire and explosion due to ignition of flammable vapors or gases. These flammable gases, like well gases, vapors, and hydrogen sulfide, can be released from wells, trucks, production equipment or surface equipment such as tanks and shale shakers.

Oil and gas well drilling and servicing activities in the oil and gas industry involve many different types of equipment and materials. Therefore, recognizing and controlling hazards is critical in preventing injuries and deaths. Some of these hazards are [7]:

- Vehicle collisions
- Struck-By/caught-in/caught-between
- Explosions and fires
- Falls
- Confined spaces
- Ergonomic hazards [8]
- High pressure lines and equipment
- Electrical and other hazardous energy
- Machine hazards
- Planning and prevention

Occupational hazards are the risks associated with working in some specific occupations. The Occupational Safety and Health Administration (OSHA) has described the five categories of

occupational hazards as: physical safety hazards, chemical hazards, biological hazards (i.e. exposure to various bacteria, viruses, and parasites), physical hazards, and ergonomic risk factors as shown in Figure 4. Furthermore, other hazards to which oil and gas (O&G) workers are exposed to also include: Silica Exposure during Hydraulic Fracturing, Diesel Particulate Matter, Fatigue, Hydrocarbon Gases and Vapors (HGVs), Low Oxygen Environments, Naturally Occurring Radioactive Material (NORM), Noise, and Temperature Extremes [9].

The report from 2013 to 2017, mentioned that 489 oil and gas extraction workers got killed on the job (Census of Fatal Occupational Injuries – CFOI) [7], as shown in Figures 5 and 6. The OSHA regulatory requirements introduced applicable industry standards and guidance which is aimed at identifying, preventing, and controlling exposure to hazards. This is coupled with the fact that employers must protect the safety and health of workers in the oil and gas operations according to [10]:

- OSHA's General Industry Standards (29 CFR 1910).
- OSHA's Construction Standards (29 CFR 1926).
- General Duty Clause of the Occupational Safety and Health (OSH) Act.

The five OSHA regions located in areas of significant upstream activities use national, regional, and local emphasis programs to inspect oilfield worksites:

- Region III
- Region VI
- Region VII
- Region VIII
- Region X

It was noted that the number of preventable work deaths increased by 5% in 2022, totaling 4,695. In addition to preventable fatal work injuries, 791 homicides and suicides occurred in the workplace in 2022, these intentional injuries are not included in the preventable-injury estimates. The large increase in preventable work deaths in 2022 was said to be partially as a result of a 3.4% increase in hours worked, and as well as the contribution from other variables. The industry sector that experienced the largest number of preventable fatal injuries in 2022 was construction, followed by transportation and warehousing. The industry sector that experienced the highest fatality rates per 100,000 workers was agriculture, forestry, fishing and hunting, followed by mining [11].

Between 80 and 90% of all workplace accidents (due to chance occurrences, unsafe conditions, and employees' unsafe acts) are caused by human error,

such as dehydration, fatigue, stress, and burnout [12, 13].

CONCLUSION

The adequate knowledge of risk management is very important in the oil and gas industries in order to prevent and mitigate the impact of uncontrollable conditions. To this end, attending oil and gas courses will surely help staff follow the rules, regulations and standards of the oil and gas industry, as well as meet all safety requirements and best practices, as this is a real investment in the company's success cum profitability. This helps to ensure that energy companies identify potential risks and implement strategies to avoid or minimize losses, thereby protecting assets and improving the bottom line.

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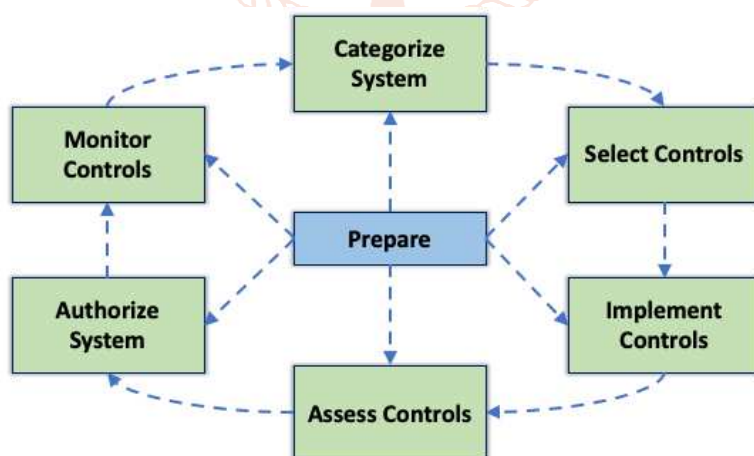


Figure 1. Risk Management Framework.

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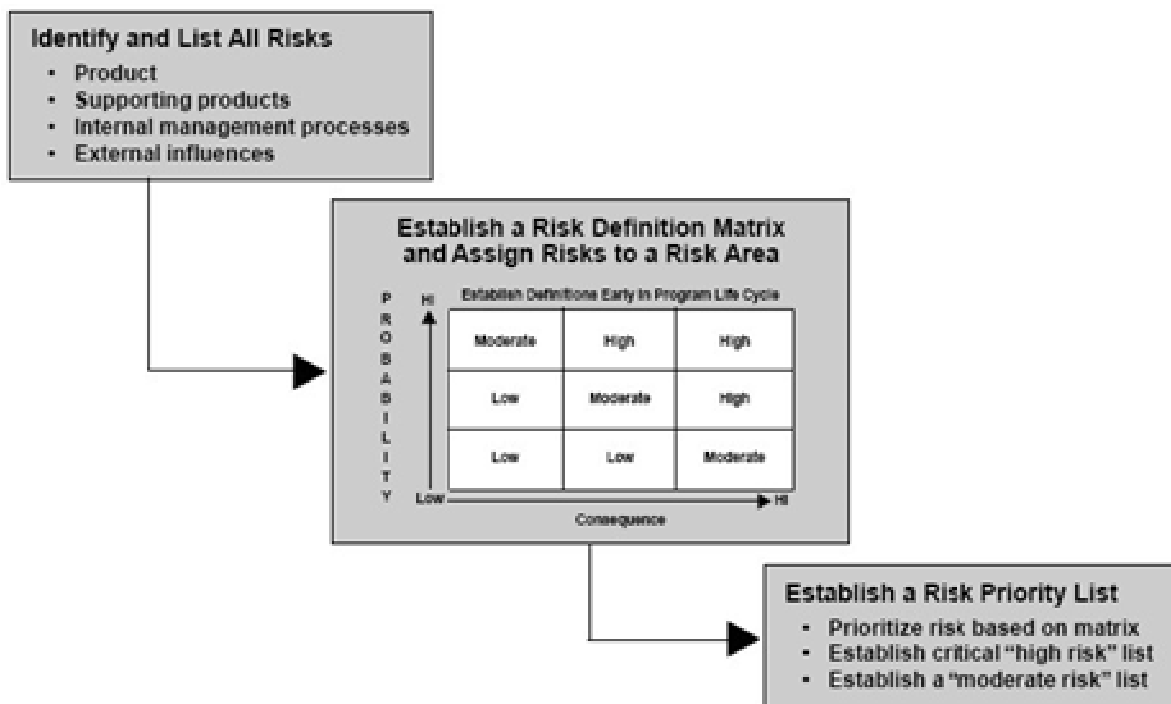


Figure 2. Risk identification.jpg

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The Link Between Time Critical and Deliberate

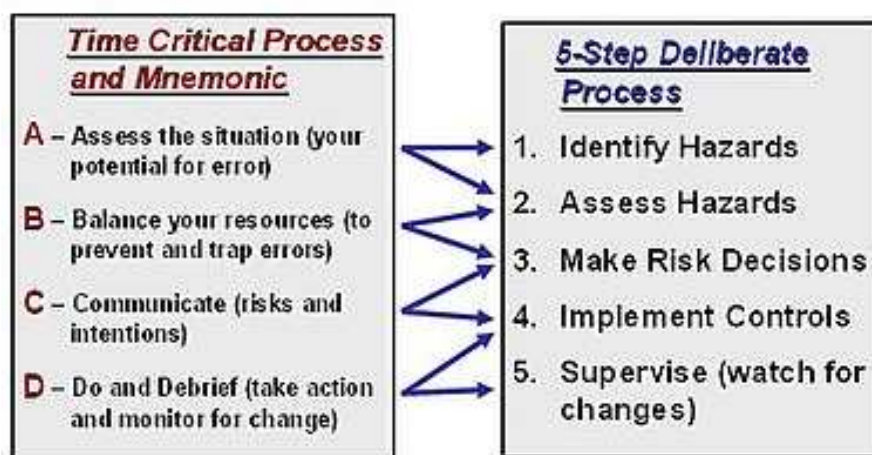


Figure 3. Operational risk management.

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Figure 4. Occupational Safety and Health Administration.

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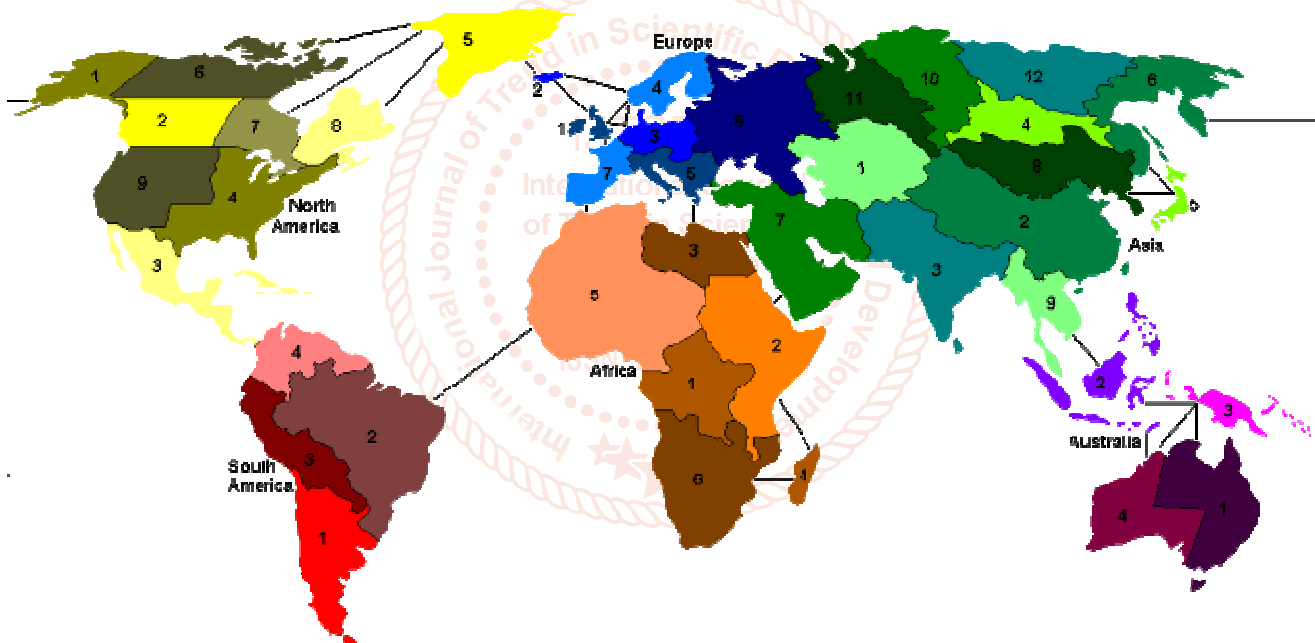


Figure 5. Risk game map.png

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Figure 6. Workers' compensation.

Source: https://www.google.com/search?sca_esv=41efd453413bdc83&sxsrf=ADLYWIKiiVYQNfb8GE5J0va78nvlL7sQWQ:1720598605555&q=images+on+risk+management+by+wikipedia&tbm=isch&source=lnms&fbs=AEQNm0Aa4sjWe7Rqy32pFwRj0UkWERaHdBms7ttHL1116ec0FnDIxrxgGhNFSZEtYqV91R7Rf5ozRZtUyfvojSh_GljRRCJ2kiQcYKrvZa7eH2W4J4Irat4x8NFnigYG4D8K7dw8_peQUvGq7T1W2PG_keWF6WHldIsVuL3fINyqI5yjR9qhiiJwNxMdKzcBwt7h91Vh&sa=X&ved=2ahUKEwjnnL2lgZyHAXWJWEAHQWOA_EQ0pQJegQIDhAB&biw=1034&bih=539&dpr=1#imgsrc=gDyHzeOkGN_9i